



SHILAP Revista de Lepidopterología

ISSN: 0300-5267

ISSN: 2340-4078

Sociedad Hispano-Luso-Americana de Lepidopterología

Laurent, R. A. St; McCabe, T. L.; Malm, T.
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SHILAP Revista de Lepidopterología, vol. 46, no. 181, 2018, June-March, pp. 157-167
Sociedad Hispano-Luso-Americana de Lepidopterología

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Revision of the genus *Aleyda* Schaus, 1928 with the description of one new species (Lepidoptera: Mimallonidae)

R. A. St Laurent, T. L. McCabe & T. Malm

Abstract

The genus *Aleyda* Schaus, 1928 is revised. The male of the type species of *Aleyda*, *A. accipiter*, is redescribed, and the female is figured for the first time. *Aleyda heppneri* St Laurent, McCabe & Malm, sp. n. from Panamá and French Guiana is newly described. Male and female genitalia of both species are figured for the first time.

KEY WORDS: Lepidoptera, Mimallonidae, *Cicinnus*, *Euphaneta*, taxonomy, French Guiana, Panama.

Revisión del género *Aleyda* Schaus, 1928 con la descripción de una nueva especie (Lepidoptera: Mimallonidae)

Resumen

Se revisa el género *Aleyda* Schaus, 1928. Se redescrive el macho de la especie tipo de *Aleyda*, *A. accipiter* y la se figura hembra por primera vez. Se describe una nueva especie *Aleyda heppneri* St Laurent, McCabe & Malm, sp. n., de Panamá y la Guyana francesa. Por primera vez, se figura la genitalia de ambas especies.

PALABRAS CLAVE: Lepidoptera, Mimallonidae, *Cicinnus*, *Euphaneta*, taxonomía, Guyana francesa, Panamá.

Introduction

This paper is part of an ongoing project revising genera belonging to the enigmatic Mimallonidae, the sole family of Mimallonoidea. *Aleyda* Schaus, 1928 was described to include the single species *Cicinnus accipiter* Dognin, 1916. Schaus's description of the genus focused predominantly on wing venation characteristics, which was standard procedure for the generic classification of SCHAUS (1928). Apart from the description of DOGNIN (1916), redescription and new combination of SCHAUS (1928), and FORBES'S (1942) brief account of *A. accipiter* from Panama, reports of *Aleyda* in the literature are sparse. Both species checklists of the family Mimallonidae included *A. accipiter* (GAEDE, 1933; BECKER, 1996).

SCHAUS (1928) figured a painting of a male *A. accipiter*, which we presume to be based on the holotype, and no other images of this species have so far been published. Here we seek to redescribe the type species *A. accipiter* in greater detail and provide photographs of both sexes for the first time. The female, briefly described by FORBES (1942), is figured here for the first time. A new species of *Aleyda* is described and the genitalia of both sexes of *A. accipiter* and the new species are figured. The male and female genital morphology is used to infer the phylogenetic relationship between *Aleyda* and two other genera.

Material and methods

Aleyda specimens are scarce in natural history collections. We studied material from the following institutions:

CUIC	Cornell University Insect Collection, Ithaca, New York, USA
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA
MGCL	McGuire Center for Lepidoptera & Biodiversity, Gainesville, Florida, USA
NHRS	Entomological Collections, Swedish Museum of Natural History, Stockholm, Sweden
NYSM	New York State Museum, Albany, New York, USA
USNM	National Museum of Natural History [formerly United States National Museum], Washington D.C., USA.

Morphological terminology follows KRISTENSEN (2003). Genitalia and abdomens are preserved in glycerol filled microcentrifuge vials, or small vials attached to the specimen's pin.

All figures were manipulated with Adobe Photoshop CS4 (Adobe 2008). The map was built with SimpleMappr (SHORTHOUSE, 2010) and edited with CS4. All geographical coordinates are approximate, and are based on the localities provided on specimen labels when coordinates were not explicitly given. GPS data were acquired with Google Earth.

Systematic part

Aleyda Schaus, 1928

Aleyda Schaus, 1928: 641

Aleida; Gaede 1931, misspelling

Aleyda; Forbes 1942

Aleyda; Becker 1996

Type species: *Cicinnus accipiter* Dognin, 1916: 20 by original designation.

Description Male: Head: Dark brown, eyes very large, occupying more than two-thirds area of head; antenna pale brown, tan, bipectinate to tip with distal third of pectination much shorter; labial palpus thin, short, not extending much beyond frons, three segmented, third segment reduced, barely visible. Thorax: Coloration as for head, scattered with black petiolate scales. Legs: Coloration as for thorax, vestiture thick, long; tibial spines short, sharp, almost entirely covered in scales. Forewing dorsum: Forewing length: 17 mm, wingspan: 32–34 mm. Narrow, elongate, outer margin concave, apex weakly falcate. Ground color chestnut brown with smoky black diffusion proximally, lighter distally, sparsely scattered with small black petiolate scales, especially antemedially. Antemedial area may be lighter gray than remainder of wing. Antemedial line outwardly convex, nearly semi-circular, reaching from costa to anal margin of wing, postmedial line inwardly concave, bent oppositely to antemedial line, not reaching costa. Maculation of postmedial line mostly restricted below cell, remainder of postmedial line faint or absent. Hyaline discal patch narrow, somewhat lunate, stretching across cell. Fringe coloration orange-brown. Forewing ventrum: As for forewing dorsum but ante- and postmedial lines more diffuse, coloration slightly lighter, especially along anal margin where coloration light gray. Black petiolate scales more prevalent. Hindwing dorsum: Rounded, margin convex, anal angle accentuated, markings like forewing dorsum but smaller, less defined. Discal hyaline patch present, but smaller, not lunate, irregularly shaped. Hindwing ventrum: Following same pattern as forewing ventrum. Frenulum absent or vestigial, unapparent. Venation: Typical of Mimallonidae, but Rs3 + Rs4 quite long-stalked with stalk only slightly shorter than bifurcation of Rs3 + Rs4. Abdomen: Relatively small in size, hardly reaching beyond anal angle of hindwing, if at all. Coloration as for thorax, black scales present at junction with thorax. Genitalia: Vinculum somewhat boxlike, ventral corners of vinculum accentuated as small, rounded, inwardly

angled knobs (apodemes). Uncus extends beyond saccular edge of valvae, triangular in shape, highly truncated along its length, widening slightly apically. Gnathos U-shaped with widened sclerotized area at base of "U" but without projections of any sort. Valvae relatively short, triangular, distally angled upward, saccular edge tightly curled channel which holds heavily sclerotized, curved arms originating from base of vinculum. Arms slightly bent mesally along length, extend inward, but do not meet. Juxta connects to rectangular mesal region of transtilla. Juxta extends ventrally as elongate, backwardly angled lip which connects to base of vinculum. Phallus short, rectangular, strongly narrowed basally. Tubular vesica bag-like, but weak and not closely examined.

Female: Head as for male, antennae smaller overall but pectination as in male, labial palpus shorter, blunter, segments less clearly defined due to thick scaling. Thorax: As for male. Legs: As for male. Forewing dorsum: Forewing length: 19-21 mm, wingspan: 38-45 mm. As for male but broader, ovoid, margin slightly convex, apex blunt, not falcate. Coloration and patterning as for male but markings more well defined, ante- and postmedial lines more strongly curved, light gray coloration more prominent, especially antemedially and postmedially near anal wing margin. Forewing ventrum: As for forewing dorsum but ante- and postmedial lines more diffuse, coloration slightly lighter, especially along anal margin and tornal area where coloration light gray. Black petiolate scales more prevalent. Hindwing dorsum: Rounded, margin convex, markings like forewing dorsum but smaller, less defined. Discal hyaline patch present, but smaller, not lunate, irregularly shaped. Hindwing ventrum: Following same pattern as forewing ventrum. Frenulum absent (or vestigial). Abdomen: As for male but more robust overall. Genitalia: Quite small relative to overall size of moth (considering other genera of Mimallonidae); tergite of VIII mostly membranous with slightly more well sclerotized V-shaped section mesally. Apophyses anteriores slightly shorter than apophyses posteriores. Lamella antevaginalis a setae-covered narrow bar, either side of lamella antevaginalis with distinct, rounded protuberances covered in short, fine setae. Ductus bursae shorter than overall size of genitalia, tube-like; corpus bursae small, bag-like, roughly equal in size to one of the setae-covered protuberances on either side of lamella antevaginalis. Papillae anales truncated ventrally.

Diagnosis: The combination of the following characteristics immediately distinguishes *Aleyda* from all known Mimallonidae genera: exceptionally narrow wings (particularly in the male), thin hyaline patches on all wings (those of the forewing being lunate), and the presence of semi-circular ante- and postmedial lines either oppositely curved or tangent to each other. Male genitalia can be recognized by the saccular curl along the valva which holds vincular tusks when in their natural position. Valvae are otherwise simple, without teeth or membranous regions as in some similar *Cicinnus* Blanchard, 1852 species. The only genus with which *Aleyda* could be confused, *Euphaneta* Schaus, 1928, have broader, more ovoid wings, lunate hyaline patches on all wings (not just the forewings), and straighter ante- and postmedial lines. The uncus of *Euphaneta* is broadly triangular, not deeply truncated as in *Aleyda*.

Remarks: *Aleyda*, as currently understood, is a small, rarely collected genus found in Costa Rica, Panama, Venezuela, and broadly in the Amazon rainforest. External morphology as well as genitalia structures of both sexes are highly reminiscent of *Euphaneta*. Shared external traits of *Aleyda* and *Euphaneta* were previously mentioned in the diagnosis. Such shared characteristics are unique to these two genera within Mimallonidae. Male genitalia of both genera also display extended vincular arms and an absence of gnathos protrusions. See HERBIN (2016, figs 115-118) for figures of male genitalia of both known *Euphaneta* species.

Although natural history information for *Aleyda* is lacking, the host plant information of the closely related *Euphaneta* is known. DINIZ *et al.* (2013) report the following hosts from Malpighiaceae for *E. divisa* (Walker, 1855): *Byrsonima coccolobifolia*, *B. pachyphylla*, and *B. verbascifolia*. However, when *Byrsonima* was offered to a newly hatched *A. accipiter* larva, it was not accepted (C. Owens pers. comm.).

Considering the similarities between *Aleyda* and *Euphaneta*, together with *Cicinnus* which display many similar genitalia characters, we believe these three genera are all very closely related,

and ongoing molecular phylogenetic work of the first author has supported this conclusion, specifically that *Aleyda* and *Euphaneta* are sister genera.

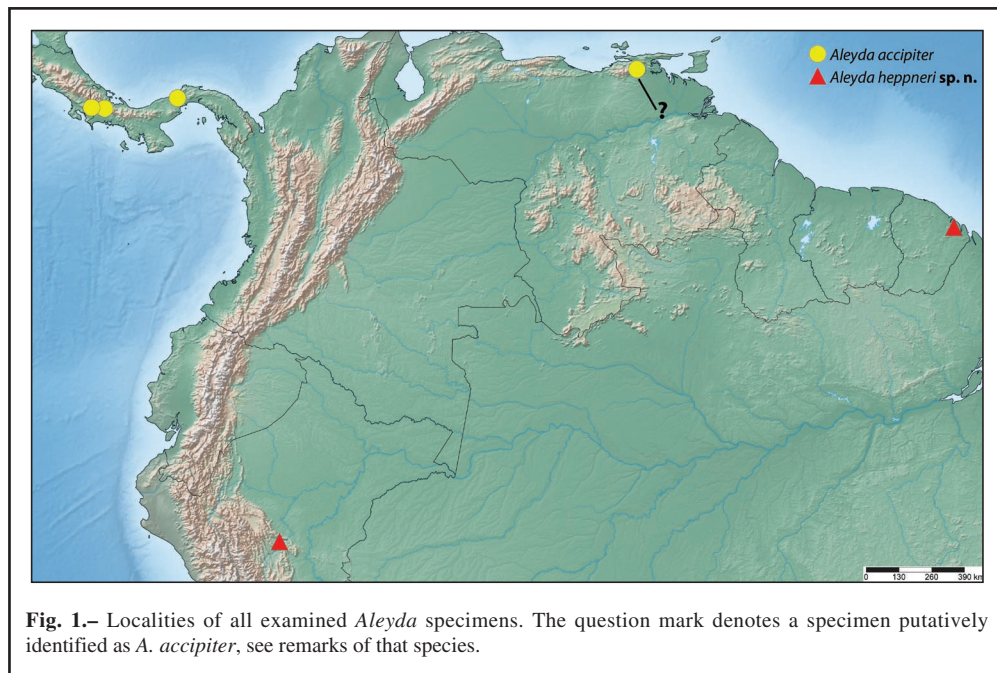


Fig. 1.— Localities of all examined *Aleyda* specimens. The question mark denotes a specimen putatively identified as *A. accipiter*, see remarks of that species.

Aleyda accipiter (Dognin, 1916) (Figs 1, 2-4, 7, 9, 11-14)

Cicinnus accipiter Dognin, 1916: 20

Aleyda accipiter; Schaus, 1928: 641, fig. 86g

Aleida accipiter; Gaede 1931, genus misspelled

Aleyda accipiter; Forbes, 1942

Aleyda accipiter; Becker, 1996

Type material: Holotype ♂. Lino Panamá [Alto Lino?], 800 m, Coll. Fassl/ Dognin Collection/ *Cicinnus accipiter* type ♂ Dgn/ USNM-Mimal: 1020/ Type No. 29697 U.S.N.M. / illegible label/ (USNM, examined). No paratypes.

Additional material examined (1 ♂, 5 ♀♀): COSTA RICA: Puntarenas: 1 ♀, Sabalito: 5-I-2018, living individual photographed by C. Owen, not collected. PANAMÁ: Panamá Oeste: 3 ♀♀, Barro Colorado Island, C. Z. [Canal Zone]: 3-XI, M. Bates leg. [St Laurent diss.: 4-24-17:1] (CUIC); 4-I-1935, M. Bates leg., MCZ-ENT 00637013 (MCZ); 2-V-1935, A. Friedman [leg.], MCZ-ENT 00637014 (MCZ). Chiriquí: 1 ♂, Lino [Alto Lino?], 800 m: Fassl [leg.], NHRS-TOBI 000001871 [dissected] (NHRS). VENEZUELA: Monagas: 1 ♀, Caripe: 26-I-2018, M. García leg. (Collection of M. García, Venezuela).

Redescription of Male: Head, thorax, legs, abdomen: As for genus. Forewing dorsum: Forewing length: 17 mm, wingspan: 32 mm (n=1). As for genus, but wing overall narrower and more elongate relative to the body than in *A. heppneri* sp. n. below. Ante- and postmedial lines never tangent to each other. Forewing ventrum: As for forewing dorsum but ante- and postmedial lines more diffuse, coloration slightly lighter, especially along anal margin where coloration light gray. Black petiolate scales more prevalent. Hindwing dorsum: As for genus, but hyaline patch wider than in *A. heppneri* sp. n. and reduced postmedial line marking situated roughly midway along anal margin of wing.

Hindwing ventrum: Following same pattern as forewing ventrum. Genitalia: (Fig. 7) As for genus but valva more acutely angled upward toward uncus, valva thus somewhat rectangular in shape distally, valva deeply curved at base at junction with vinculum. Uncus narrow, handbell shaped. Phallus short, rectangular, narrowed basally, posterior lobe short, straight.

Redescription of Female: Head as for male, antennae smaller overall but pectination as in male. Thorax: As for male. Legs: As for male. Forewing dorsum: Forewing length: 19 mm, wingspan: 38 mm, n=1. As for male but broader, ovoid, margin slightly convex, apex blunt, not falcate. Coloration and patterning as for male but markings more well defined, ante- and postmedial lines more strongly curved, light gray coloration more prominent, especially antemedially and postmedially near anal wing margin. Forewing ventrum: As for forewing dorsum but ante- and postmedial lines more diffuse, coloration slightly lighter, especially along anal margin and tornal area where coloration light gray. Black petiolate scales more prevalent. Hindwing dorsum: Rounded, margin convex, markings like forewing dorsum but smaller, less defined, similar to male but postmedial line marking situated closer to thorax, roughly one quarter length of anal wing margin distal from thorax. Discal hyaline patch present, but smaller, not lunate, irregularly shaped. Hindwing ventrum: Following same pattern as forewing ventrum. Abdomen: As for male but more robust overall. Genitalia: (Fig. 9) As for genus but lamella antevaginalis smoothly curved, setae covered lobes on either side of lamella antevaginalis regularly shaped, ovoid. Ventral margins of papillae anales truncated to form small lobes.

Diagnosis: The sharply acute forewings of the male distinguish this species from the only congener *A. heppneri* sp. n. Furthermore, the ante- and postmedial lines are never touching in either sex, the opposite is true in *A. heppneri* sp. n. where the semicircular lines are tangent, or at least barely touching due to black diffusions between the lines (in the single examined female). Male genitalia are recognized by the deep curve upward of the valvae where they meet the vinculum as well as by the more rectangular shape of the valvae, which are smoothly curved in *A. heppneri* sp. n. The uncus is much narrower in *A. accipiter* and the phallus smaller with a squared terminus as oppose to a downwardly angled apex in *A. heppneri* sp. n. The margin of the lamella antevaginalis is smooth in female *A. accipiter*, and irregularly edged in *A. heppneri* sp. n.

Remarks: This species was described by DOGNIN (1916) from a single male specimen. An additional male from the same locality and collector as the holotype was located in NHRS. Apart from these two males, no others have been located by the authors. Several females from Panama in the MCZ as well as a recently photographed live specimen (Figs 11-13) from Costa Rica represent the only other examined specimens of this rare species. The Costa Rican report is a country record for *A. accipiter*. Vitor Becker (pers. comm.) mentioned that he has had this species in his collection, but we were unable to examine this material.

The discovery of the aforementioned live female *A. accipiter* from Costa Rica (Figs 11-13) provided some valuable information pertaining to the life history of this species. The individual was observed, during the day (first seen at 15.33 h local time) in Sabalito, Costa Rica. According to the observer, C. Owen, the specimen arrived during the daylight hours (C. Owen pers. comm.). Therefore, it is possible that *A. accipiter* displays at least some diurnal behavior, which would help explain the rarity of this species in collections. This individual laid a single, cylindrical green egg (Fig. 14). The egg eclosed 10 days later. The hatchling first instar larva appeared typical of related mimallonid genera *Cicinnus* and *Euphaneta*. The larva was offered *Byrsonima* and *Psidium* L. (Myrtaceae), but did not feed and perished (C. Owen pers. obs.). These unique observations will hopefully encourage future work on the life history of this species.

An additional newly observed *Aleyda* specimen was brought to the first author's attention. A single female was collected in Caripe, Venezuela by M. Garcia. We were able to examine a photo of this specimen, and putatively identify it as *A. accipiter* due to the fact that the ante- and postmedial lines of the forewings are not tangent, but rather are clearly separate as in all examined *A. accipiter*. This record is the first for this genus from Venezuela, and greatly expands the known distribution of *A. accipiter* assuming that this population is indeed conspecific with the Central American populations.

***Aleyda heppneri* St Laurent, McCabe, & Malm, sp. n.** (Figs 1, 5, 6, 8, 10)

Type material: Holotype ♂: PERU: San Martin 225 m, Pumarini Lodge, 10 km E., Shapaja 24-27 Oct 2012, J. B. Heppner & C. Carrera [06.36.27°, -76.12.51°]/ HOLOTYPE male *Aleyda heppneri* St Laurent and McCabe, 2018 [handwritten red label]/ PROJECT PHOTO J. B. Heppner 13435/ St Laurent diss.: 3-30-17:1 (MGCL). Paratype (1 ♀): FRENCH GUIANA: 1 km W. Amazonia, 04.34.08°, -52.12.37°, 290 m: 9-II-2005, T. McCabe [leg.], St Laurent diss.: 3-27-17:1, Paratype female *Aleyda heppneri* St Laurent, McCabe & Malm, 2018 [yellow label] (NYSM).

Description Male: Head, thorax, legs, abdomen: As for genus. Forewing dorsum: Forewing length: 17 mm, wingspan: 34 mm, $n = 1$. As for genus, but wing overall shorter and blunter than in *A. accipiter* above. Ante- and postmedial lines tangent to each other. Gray coloration well defined antemedially. Forewing ventrum: As for forewing dorsum but ante- and postmedial lines more diffuse, coloration slightly lighter, especially along anal margin where coloration light gray. Black petiolate scales more prevalent. Hindwing dorsum: As for genus, but hyaline patch narrower than in *A. accipiter*, reduced postmedial line marking situated roughly one quarter along anal margin of wing. Hindwing ventrum: Following same pattern as forewing ventrum. Genitalia: (Fig. 8) As for genus but valva smoothly curved, deeply curved at base where valva meets vinculum. Uncus triangular. Phallus relatively long, somewhat ovoid with distal terminus downwardly sloping, phallus strongly narrowed basally with posterior lobe downturned.

Female: Head as for male, antennae smaller overall but pectination as in male. Thorax: As for male. Legs: As for male. Forewing dorsum: Forewing length: 21 mm, wingspan: ~45 mm, $n=1$. As for male but broader, ovoid, margin slightly convex, apex blunt, not falcate. Coloration and patterning as for male but markings more well defined, ante- and postmedial lines more strongly curved, light gray coloration more prominent, especially antemedially and postmedially near anal wing margin, lines not touching as in male. Forewing ventrum: As for forewing dorsum but ante- and postmedial lines more diffuse, coloration slightly lighter, especially along anal margin and tornal area where coloration light gray. Black petiolate scales more prevalent. Hindwing dorsum: Rounded, margin convex, markings like forewing dorsum but smaller, less defined. Discal hyaline patch present, but smaller, not lunate, irregularly shaped. Hindwing ventrum: Following same pattern as forewing ventrum. Abdomen: As for male but more robust overall. Genitalia: (Fig. 10) As for genus but lamella antevaginalis irregularly edged, setae covered lobes on either side of lamella antevaginalis also irregular, with anterior margin of VIII with narrow sclerotized region devoid of setae.

Diagnosis: Conversely to the diagnosis of *A. accipiter*, the blunt, less elongated forewings of the male distinguishes *A. heppneri* from *A. accipiter*. Additionally, the ante- and postmedial lines are tangent to one another, or are at least barely touching due to black diffusions between the lines (in the single examined female). Male genitalia are recognized by smoothly curved valvae and the broader, more triangular uncus. The phallus of *A. heppneri* is larger, with a downturned terminus as oppose to the rectangular end of the *A. accipiter* phallus. The irregular edge of the lamella antevaginalis in female *A. heppneri* distinguishes it from the smooth edged *A. accipiter*.

Remarks: Considering external and genitalia morphology differences between the holotype of *A. heppneri* and *A. accipiter*, we consider the species here described from Peru and French Guiana as distinct enough to warrant specific status. Mimallonidae fauna of the Amazon basin are widely distributed within this biome, and taxa are largely shared between French Guiana and lowland Peruvian Amazon (McCabe and St Laurent pers. obs.). This, and the fact that the ante- and postmedial lines are placed closer together on the French Guiana female than in any of the five examined females of *A. accipiter*, corresponds well to this character of the male.

Etymology: This species is named for the collector of the holotype, John Heppner (MGCL), who kindly provided the holotype to the first author for study.

Acknowledgements

Casey Owen (Costa Rica) provided vital life history information pertaining to an observed *A.*

accipiter, and gave us permission to publish her excellent photos documenting this observation. Marcial García (Venezuela) offered important locality information regarding a recently collected *Aleyda* specimen from Venezuela. We would like to thank the following individuals and their institutions for providing the specimens, or photos of specimens, that were utilized in this study: Jason Dombroskie (CUIC), Rachel Hawkins (MCZ), John Heppner (MGCL), Daniel Herbin (France), and Roger Hutchings, Vitor O. Becker (Brazil).

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*R. A. S.

McGuire Center for Lepidoptera and Biodiversity
Florida Museum of Natural History
Department of Biology
University of Florida
3215 Hull Road, Gainesville, FL 32611-2710
EE.UU. / USA
E-mail: rstlaurent@flmnh.ufl.edu

T. L. M.

New York State Museum
222 Madison Ave
Albany, NY 12230
EE.UU. / USA
E-mail: timothy.mccabe@nysed.gov

T. M.

Department of Zoology
Swedish Museum of Natural History
P.O. Box 50007
SE-104 05 Stockholm
SUECIA / SWEDEN
E-mail: tobias.malm@nrm.se

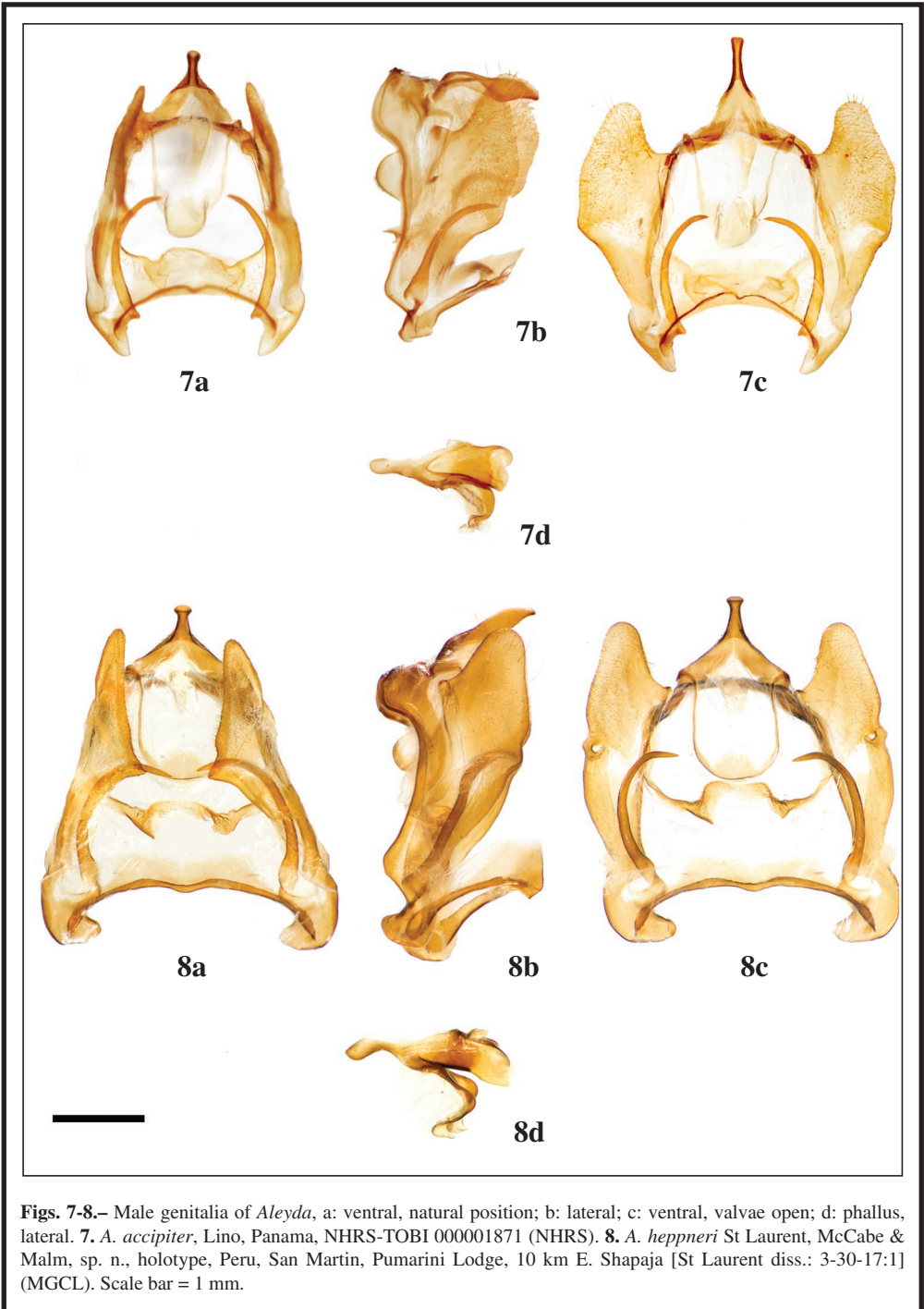
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(Recibido para publicación / *Received for publication* 29-IX-2017)

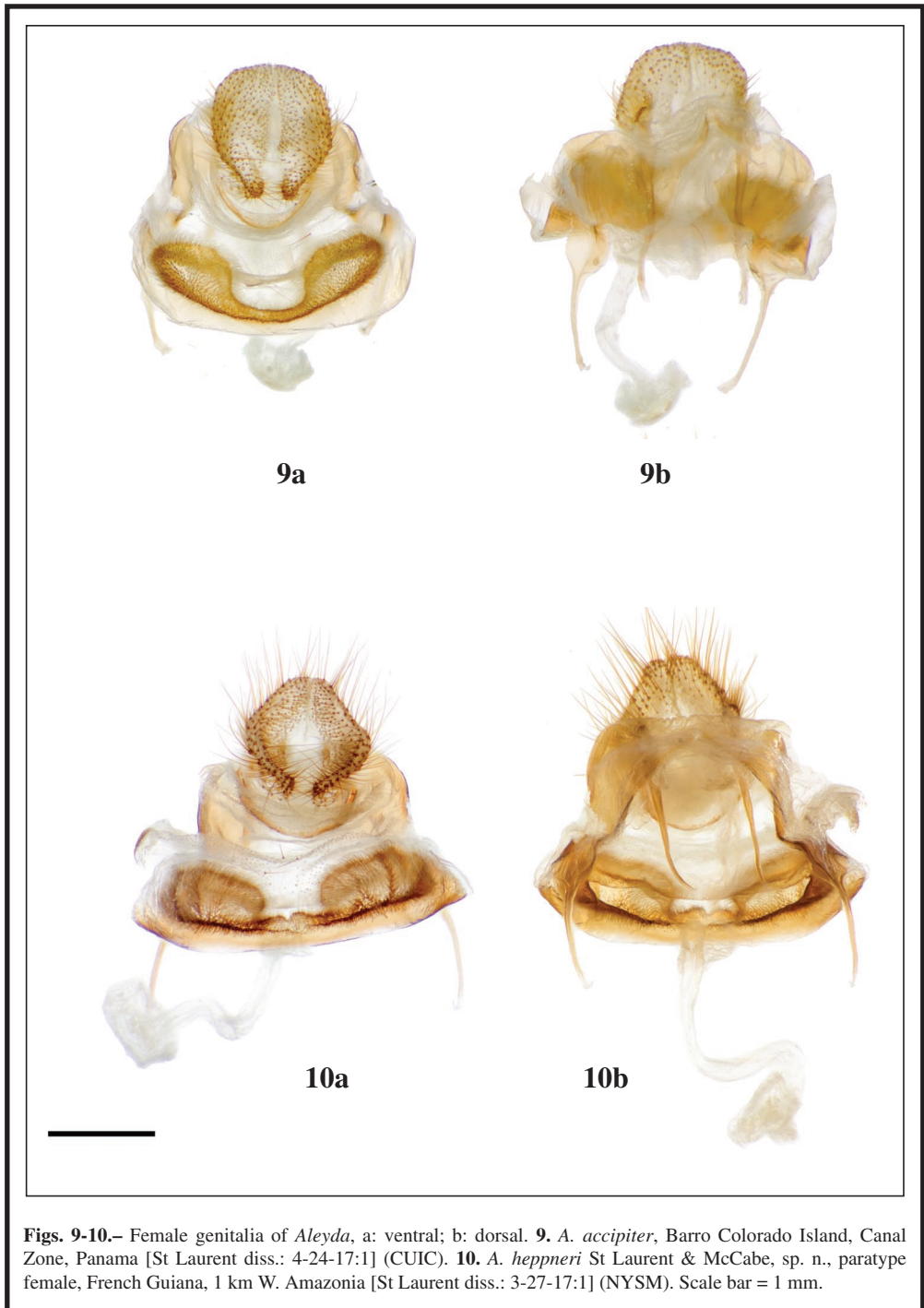
(Revisado y aceptado / *Revised and accepted* 30-X-2017)

(Publicado / *Published* 30-III-2018)

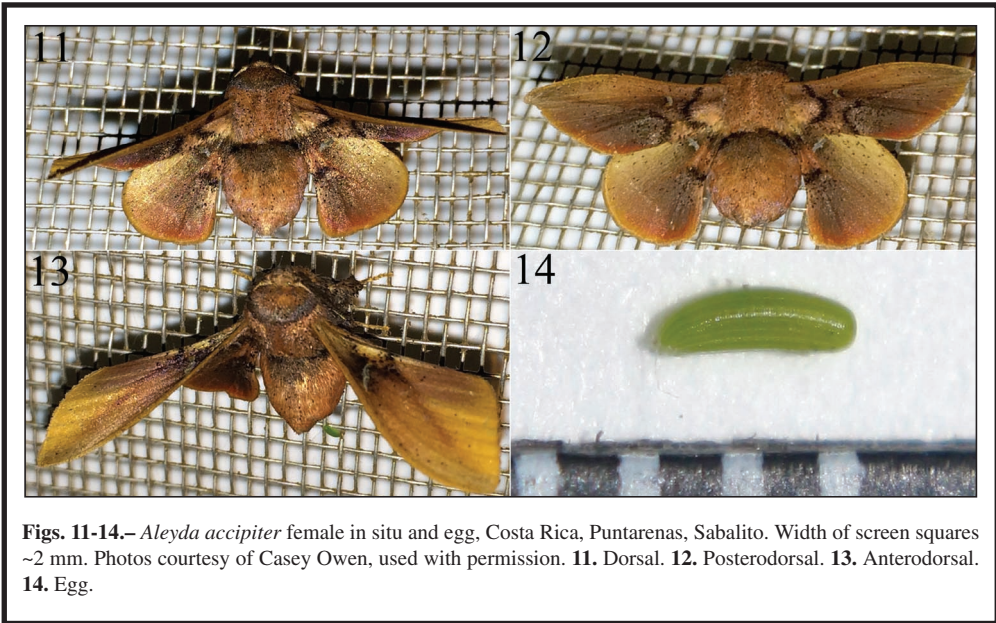




Figs. 7-8.— Male genitalia of *Aleyda*, a: ventral, natural position; b: lateral; c: ventral, valvae open; d: phallus, lateral. 7. *A. accipiter*, Lino, Panama, NHRS-TOBI 000001871 (NHRS). 8. *A. heppneri* St Laurent, McCabe & Malm, sp. n., holotype, Peru, San Martin, Pumarini Lodge, 10 km E. Shapaja [St Laurent diss.: 3-30-17:1] (MGCL). Scale bar = 1 mm.



Figs. 9-10.— Female genitalia of *Aleyda*, a: ventral; b: dorsal. **9.** *A. accipiter*, Barro Colorado Island, Canal Zone, Panama [St Laurent diss.: 4-24-17:1] (CUIC). **10.** *A. heppneri* St Laurent & McCabe, sp. n., paratype female, French Guiana, 1 km W. Amazonia [St Laurent diss.: 3-27-17:1] (NYSM). Scale bar = 1 mm.



Figs. 11-14.– *Aleyda accipiter* female in situ and egg, Costa Rica, Puntarenas, Sabalito. Width of screen squares ~2 mm. Photos courtesy of Casey Owen, used with permission. **11.** Dorsal. **12.** Posterodorsal. **13.** Anterodorsal. **14.** Egg.